

SEQUENCE LISTING

<110> The University of North Carolina at Chapel Hill
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<120> PURIFIED AND ISOLATED HEPARAN SULFATE 3-O-SULFOTRANSFERASE
ISOFORM 5 NUCLEIC ACIDS AND POLYPEPTIDES AND THERAPEUTIC AND
SCREENING METHODS USING SAME

<130> 421/67/2

<150> US 60/394,199

<151> 2002-07-05

<160> 12

<170> PatentIn version 3.2

<210> 1

<211> 1041

<212> DNA

<213> Homo sapiens

<220>

<221> CDS

<222> (1)..(1041)

<400> 1

atg cta ttc aaa cag cag gcg tgg ctg aga cag aag ctc ctg gtg ctg	48
Met Leu Phe Lys Gln Gln Ala Trp Leu Arg Gln Lys Leu Leu Val Leu	
1 5 10 15	
gga agc ctt gcc gtt ggg agt ctc ctg tat cta gtc gcc aga gtt ggg	96
Gly Ser Leu Ala Val Gly Ser Leu Tyr Leu Val Ala Arg Val Gly	
20 25 30	
agc ttg gat agg cta caa ccc att tgc ccc att gaa ggt cga ctg ggt	144
Ser Leu Asp Arg Leu Gln Pro Ile Cys Pro Ile Glu Gly Arg Leu Gly	
35 40 45	
gga gcc cgc act cag gct gaa ttc cca ctt cgc gcc ctg cag ttt aag	192
Gly Ala Arg Thr Gln Ala Glu Phe Pro Leu Arg Ala Leu Gln Phe Lys	
50 55 60	
cgt ggc ctg ctg cac gag ttc cgg aag ggc aac gct tcc aag gag cag	240
Arg Gly Leu Leu His Glu Phe Arg Lys Gly Asn Ala Ser Lys Glu Gln	
65 70 75 80	
gtt cgc ctc cat gac ctg gtc cag cag ctc ccc aag gcc att atc att	288
Val Arg Leu His Asp Leu Val Gln Gln Leu Pro Lys Ala Ile Ile Ile	
85 90 95	
ggg gtg agg aaa gga ggc aca agg gcc ctg ctt gaa atg ctg aac cta	336
Gly Val Arg Lys Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Asn Leu	
100 105 110	
cat ccg gca gta gtc aaa gcc tct caa gaa atc cac ttt ttt gat aat	384
His Pro Ala Val Val Lys Ala Ser Gln Glu Ile His Phe Phe Asp Asn	
115 120 125	

gat gag aat tat ggt aag ggc att gag tgg tat agg aaa aag atg cct 432
Asp Glu Asn Tyr Gly Lys Gly Ile Glu Trp Tyr Arg Lys Lys Met Pro
130 135 140

ttt tcc tac cct cag caa atc aca att gaa aag agc cca gca tat ttt 480
Phe Ser Tyr Pro Gln Gln Ile Thr Ile Glu Lys Ser Pro Ala Tyr Phe
145 150 155 160

atc aca gag gag gtt cca gaa agg att tac aaa atg aac tca tcc atc 528
Ile Thr Glu Glu Val Pro Glu Arg Ile Tyr Lys Met Asn Ser Ser Ile
165 170 175

aag ttg ttg atc att gtc agg gag cca acc aca aga gct att tct gat 576
Lys Leu Leu Ile Ile Val Arg Glu Pro Thr Thr Arg Ala Ile Ser Asp
180 185 190

tat act cag gtg cta gag ggg aag gag agg aag aac aaa act tat tac 624
Tyr Thr Gln Val Leu Glu Gly Lys Glu Arg Lys Asn Lys Thr Tyr Tyr
195 200 205

aag ttt gag aag ctg gcc ata gac cct aat aca tgc gaa gtg aac aca 672
Lys Phe Glu Lys Leu Ala Ile Asp Pro Asn Thr Cys Glu Val Asn Thr
210 215 220

aaa tac aaa gca gta aga acc agc atc tac acc aaa cat ctg gaa agg 720
Lys Tyr Lys Ala Val Arg Thr Ser Ile Tyr Thr Lys His Leu Glu Arg
225 230 235 240

tgg ttg aaa tac ttt cca att gag caa ttt cat gtc gtc gat gga gat 768
Trp Leu Lys Tyr Phe Pro Ile Glu Gln Phe His Val Val Asp Gly Asp
245 250 255

cgc ctc atc acg gaa cct ctg cca gaa ctt cag ctc gtg gag aag ttc 816
Arg Leu Ile Thr Glu Pro Leu Pro Glu Leu Gln Leu Val Glu Lys Phe
260 265 270

cta aat ctg cct cca agg ata agt caa tac aat tta tac ttc aat gct 864
Leu Asn Leu Pro Pro Arg Ile Ser Gln Tyr Asn Leu Tyr Phe Asn Ala
275 280 285

acc aga ggg ttt tac tgc ttg cgg ttt aat att atc ttt aat aag tgc 912
Thr Arg Gly Phe Tyr Cys Leu Arg Phe Asn Ile Ile Phe Asn Lys Cys
290 295 300

ctg gcg ggc agc aag ggg cgc att cat cca gag gtg gac ccc tct gtc 960
Leu Ala Gly Ser Lys Gly Arg Ile His Pro Glu Val Asp Pro Ser Val
305 310 315 320

att act aaa ttg cgc aaa ttc ttt cat cct ttt aat caa aaa ttt tac 1008
Ile Thr Lys Leu Arg Lys Phe Phe His Pro Phe Asn Gln Lys Phe Tyr
325 330 335

cag atc act ggg agg aca ttg aac tgg ccc taa 1041
Gln Ile Thr Gly Arg Thr Leu Asn Trp Pro
340 345

<210> 2
<211> 346
<212> PRT
<213> Homo sapiens

<400> 2

Met Leu Phe Lys Gln Gln Ala Trp Leu Arg Gln Lys Leu Leu Val Leu
 1 5 10 15

Gly Ser Leu Ala Val Gly Ser Leu Leu Tyr Leu Val Ala Arg Val Gly
 20 25 30

Ser Leu Asp Arg Leu Gln Pro Ile Cys Pro Ile Glu Gly Arg Leu Gly
 35 40 45

Gly Ala Arg Thr Gln Ala Glu Phe Pro Leu Arg Ala Leu Gln Phe Lys
 50 55 60

Arg Gly Leu Leu His Glu Phe Arg Lys Gly Asn Ala Ser Lys Glu Gln
 65 70 75 80

Val Arg Leu His Asp Leu Val Gln Gln Leu Pro Lys Ala Ile Ile Ile
 85 90 95

Gly Val Arg Lys Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Asn Leu
 100 105 110

His Pro Ala Val Val Lys Ala Ser Gln Glu Ile His Phe Phe Asp Asn
 115 120 125

Asp Glu Asn Tyr Gly Lys Gly Ile Glu Trp Tyr Arg Lys Lys Met Pro
 130 135 140

Phe Ser Tyr Pro Gln Gln Ile Thr Ile Glu Lys Ser Pro Ala Tyr Phe
 145 150 155 160

Ile Thr Glu Glu Val Pro Glu Arg Ile Tyr Lys Met Asn Ser Ser Ile
 165 170 175

Lys Leu Leu Ile Ile Val Arg Glu Pro Thr Thr Arg Ala Ile Ser Asp
 180 185 190

Tyr Thr Gln Val Leu Glu Gly Lys Glu Arg Lys Asn Lys Thr Tyr Tyr
 195 200 205

Lys Phe Glu Lys Leu Ala Ile Asp Pro Asn Thr Cys Glu Val Asn Thr
 210 215 220

Lys Tyr Lys Ala Val Arg Thr Ser Ile Tyr Thr Lys His Leu Glu Arg
 225 230 235 240

Trp Leu Lys Tyr Phe Pro Ile Glu Gln Phe His Val Val Asp Gly Asp
245 250 255

Arg Leu Ile Thr Glu Pro Leu Pro Glu Leu Gln Leu Val Glu Lys Phe
260 265 270

Leu Asn Leu Pro Pro Arg Ile Ser Gln Tyr Asn Leu Tyr Phe Asn Ala
275 280 285

Thr Arg Gly Phe Tyr Cys Leu Arg Phe Asn Ile Ile Phe Asn Lys Cys
290 295 300

Leu Ala Gly Ser Lys Gly Arg Ile His Pro Glu Val Asp Pro Ser Val
305 310 315 320

Ile Thr Lys Leu Arg Lys Phe Phe His Pro Phe Asn Gln Lys Phe Tyr
325 330 335

Gln Ile Thr Gly Arg Thr Leu Asn Trp Pro
340 345

<210> 3
<211> 307
<212> PRT
<213> Homo sapiens

<400> 3

Met Ala Ala Leu Leu Leu Gly Ala Val Leu Leu Val Ala Gln Pro Gln
1 5 10 15

Leu Val Pro Ser Arg Pro Ala Glu Leu Gly Gln Gln Glu Leu Leu Arg
20 25 30

Lys Ala Gly Thr Leu Gln Asp Asp Val Arg Asp Gly Val Ala Pro Asn
35 40 45

Gly Ser Ala Gln Gln Leu Pro Gln Thr Ile Ile Ile Gly Val Arg Lys
50 55 60

Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Ser Leu His Pro Asp Val
65 70 75 80

Ala Ala Ala Glu Asn Glu Val His Phe Phe Asp Trp Glu Glu His Tyr
85 90 95

Ser His Gly Leu Gly Trp Tyr Leu Ser Gln Met Pro Phe Ser Trp Pro
 100 105 110

His Gln Leu Thr Val Glu Lys Thr Pro Ala Tyr Phe Thr Ser Pro Lys
 115 120 125

Val Pro Glu Arg Val Tyr Ser Met Asn Pro Ser Ile Arg Leu Leu Leu
 130 135 140

Ile Leu Arg Asp Pro Ser Glu Arg Val Leu Ser Asp Tyr Thr Gln Val
 145 150 155 160

Phe Tyr Asn His Met Gln Lys His Lys Pro Tyr Pro Ser Ile Glu Glu
 165 170 175

Phe Leu Val Arg Asp Gly Arg Leu Asn Val Asp Tyr Lys Ala Leu Asn
 180 185 190

Arg Ser Leu Tyr His Val His Met Gln Asn Trp Leu Arg Phe Phe Pro
 195 200 205

Leu Arg His Ile His Ile Val Asp Gly Asp Arg Leu Ile Arg Asp Pro
 210 215 220

Phe Pro Glu Ile Gln Lys Val Glu Arg Phe Leu Lys Leu Ser Pro Gln
 225 230 235 240

Ile Asn Ala Ser Asn Phe Tyr Phe Asn Lys Thr Lys Gly Phe Tyr Cys
 245 250 255

Leu Arg Asp Ser Gly Arg Asp Arg Cys Leu His Glu Ser Lys Gly Arg
 260 265 270

Ala His Pro Gln Val Asp Pro Lys Leu Leu Asn Lys Leu His Glu Tyr
 275 280 285

Phe His Glu Pro Asn Lys Lys Phe Phe Glu Leu Val Gly Arg Thr Phe
 290 295 300

Asp Trp His
 305

<210> 4
 <211> 406
 <212> PRT
 <213> Homo sapiens

<400> 4

Met Ala Pro Pro Gly Pro Ala Ser Ala Leu Ser Thr Ser Ala Glu Pro
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Leu Ser Arg Ser Ile Phe Arg Lys Phe Leu Leu Met Leu Cys Ser Leu
 20 25 30

Leu Thr Ser Leu Tyr Val Phe Tyr Cys Leu Ala Glu Arg Cys Gln Thr
 35 40 45

Leu Ser Gly Pro Val Val Gly Leu Ser Gly Gly Gly Glu Glu Ala Gly
 50 55 60

Ala Pro Gly Gly Gly Val Leu Ala Gly Gly Pro Arg Glu Leu Ala Val
 65 70 75 80

Trp Pro Ala Ala Ala Gln Arg Lys Arg Leu Leu Gln Leu Pro Gln Trp
 85 90 95

Arg Arg Arg Arg Pro Pro Ala Pro Arg Asp Asp Gly Glu Glu Ala Ala
 100 105 110

Trp Glu Glu Glu Ser Pro Gly Leu Ser Gly Gly Pro Gly Gly Ser Gly
 115 120 125

Ala Gly Ser Thr Val Ala Glu Ala Pro Pro Gly Thr Leu Ala Leu Leu
 130 135 140

Leu Asp Glu Gly Ser Lys Gln Leu Pro Gln Ala Ile Ile Ile Gly Val
 145 150 155 160

Lys Lys Gly Gly Thr Arg Ala Leu Leu Glu Phe Leu Arg Val His Pro
 165 170 175

Asp Val Arg Ala Val Gly Ala Glu Pro His Phe Phe Asp Arg Ser Tyr
 180 185 190

Asp Lys Gly Leu Ala Trp Tyr Arg Asp Leu Met Pro Arg Thr Leu Asp
 195 200 205

Gly Gln Ile Thr Met Glu Lys Thr Pro Ser Tyr Phe Val Thr Arg Glu
 210 215 220

Ala Pro Ala Arg Ile Ser Ala Met Ser Lys Asp Thr Lys Leu Ile Val
 225 230 235 240

Val Val Arg Asp Pro Val Thr Arg Ala Ile Ser Asp Tyr Thr Gln Thr
245 250 255

Leu Ser Lys Arg Pro Asp Ile Pro Thr Phe Glu Ser Leu Thr Phe Lys
260 265 270

Asn Arg Thr Ala Gly Leu Ile Asp Thr Ser Trp Ser Ala Ile Gln Ile
275 280 285

Gly Ile Tyr Ala Lys His Leu Glu His Trp Leu Arg His Phe Pro Ile
290 295 300

Arg Gln Met Leu Phe Val Ser Gly Glu Arg Leu Ile Ser Asp Pro Ala
305 310 315 320

Gly Glu Leu Gly Arg Val Gln Asp Phe Leu Gly Leu Lys Arg Ile Ile
325 330 335

Thr Asp Lys His Phe Tyr Phe Asn Lys Thr Lys Gly Phe Pro Cys Leu
340 345 350

Lys Lys Ala Glu Gly Ser Ser Arg Pro His Cys Leu Gly Lys Thr Lys
355 360 365

Gly Arg Thr His Pro Glu Ile Asp Arg Glu Val Val Arg Arg Leu Arg
370 375 380

Glu Phe Tyr Arg Pro Phe Asn Leu Lys Phe Tyr Gln Met Thr Gly His
385 390 395 400

Asp Phe Gly Trp Asp Gly
405

<210> 5
<211> 390
<212> PRT
<213> Homo sapiens

<400> 5

Met Gly Gln Arg Leu Ser Gly Gly Arg Ser Cys Leu Asp Val Pro Gly
1 5 10 15

Arg Leu Leu Pro Gln Pro Pro Pro Pro Pro Pro Val Arg Arg Lys
20 25 30

Leu Ala Leu Leu Phe Ala Met Leu Cys Val Trp Leu Tyr Met Phe Leu
 35 40 45

Tyr Ser Cys Ala Gly Ser Cys Ala Ala Ala Pro Gly Leu Leu Leu Leu
 50 55 60

Gly Ser Gly Ser Arg Ala Ala His Asp Pro Pro Ala Leu Ala Thr Ala
 65 70 75 80

Pro Asp Gly Thr Pro Pro Arg Leu Pro Phe Arg Ala Pro Pro Ala Thr
 85 90 95

Pro Leu Ala Ser Gly Lys Glu Met Ala Glu Gly Ala Ala Ser Pro Glu
 100 105 110

Glu Gln Ser Pro Glu Val Pro Asp Ser Pro Ser Pro Ile Ser Ser Phe
 115 120 125

Phe Ser Gly Ser Gly Ser Lys Gln Leu Pro Gln Ala Ile Ile Ile Gly
 130 135 140

Val Lys Lys Gly Gly Thr Arg Ala Leu Leu Glu Phe Leu Arg Val His
 145 150 155 160

Pro Asp Val Arg Ala Val Gly Ala Glu Pro His Phe Phe Asp Arg Ser
 165 170 175

Tyr Asp Lys Gly Leu Ala Trp Tyr Arg Asp Leu Met Pro Arg Thr Leu
 180 185 190

Asp Gly Gln Ile Thr Met Glu Lys Thr Pro Ser Tyr Phe Val Thr Arg
 195 200 205

Glu Ala Pro Ala Arg Ile Ser Ala Met Ser Lys Asp Thr Lys Leu Ile
 210 215 220

Val Val Val Arg Asp Pro Val Thr Arg Ala Ile Ser Asp Tyr Thr Gln
 225 230 235 240

Thr Leu Ser Lys Arg Pro Asp Ile Pro Thr Phe Glu Ser Leu Thr Phe
 245 250 255

Lys Asn Arg Thr Ala Gly Leu Ile Asp Thr Ser Trp Ser Ala Ile Gln
 260 265 270

Ile Gly Ile Tyr Ala Lys His Leu Glu His Trp Leu Arg His Phe Pro
 275 280 285

Ile Arg Gln Met Leu Phe Val Ser Gly Glu Arg Leu Ile Ser Asp Pro
 290 295 300

Ala Gly Glu Leu Gly Arg Val Gln Asp Phe Leu Gly Leu Lys Arg Ile
 305 310 315 320

Ile Thr Asp Lys His Phe Tyr Phe Asn Lys Thr Lys Gly Phe Pro Cys
 325 330 335

Leu Lys Lys Ala Glu Gly Ser Ser Arg Pro His Cys Leu Gly Lys Thr
 340 345 350

Lys Gly Arg Thr His Pro Glu Ile Asp Arg Glu Val Val Arg Arg Leu
 355 360 365

Arg Glu Phe Tyr Arg Pro Phe Asn Leu Lys Phe Tyr Gln Met Thr Gly
 370 375 380

His Asp Phe Gly Trp Asp
 385 390

<210> 6
 <211> 23
 <212> DNA
 <213> Artificial

<220>
 <223> 5'-primer for exon 1 of human 3-OST-5

<400> 6
 ggagggccat gctattcaaa cag

23

<210> 7
 <211> 21
 <212> DNA
 <213> Artificial

<220>
 <223> 3'-primer for exon 2 of human 3-OST-5

<400> 7
 ttagggccag ttcaatgtcc t

21

<210> 8
 <211> 27
 <212> DNA
 <213> Artificial

<220>
 <223> 5'-primer for amplification of human 3-OST-5 in pGEM-T-3OST5

 <400> 8
 tcaaagcttg ccaccatgct attcaaa 27

 <210> 9
 <211> 27
 <212> DNA
 <213> Artificial

 <220>
 <223> 3'-primer for amplification of human 3-OST-5 in pGEM-T-3OST5

 <400> 9
 tctagattag ggccagttca atgtcct 27

 <210> 10
 <211> 343
 <212> PRT
 <213> Artificial

 <220>
 <223> C-terminal portion of human 3-OST-5 linked to honeybee melittin
 signal sequence for incorporation in baculovirus expression
 plasmid

 <400> 10

 Met Lys Phe Leu Val Asn Val Ala Leu Val Phe Met Val Val Tyr Ile
 1 5 10 15

 Ser Tyr Ile Tyr Ala Asp Arg Trp Ile Pro Arg Val Gly Ser Leu Asp
 20 25 30

 Arg Leu Gln Pro Ile Cys Pro Ile Glu Gly Arg Leu Gly Gly Ala Arg
 35 40 45

 Thr Gln Ala Glu Phe Pro Leu Arg Ala Leu Gln Phe Lys Arg Gly Leu
 50 55 60

 Leu His Glu Phe Arg Lys Gly Asn Ala Ser Lys Glu Gln Val Arg Leu
 65 70 75 80

 His Asp Leu Val Gln Gln Leu Pro Lys Ala Ile Ile Ile Gly Val Arg
 85 90 95

 Lys Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Asn Leu His Pro Ala
 100 105 110

 Val Val Lys Ala Ser Gln Glu Ile His Phe Phe Asp Asn Asp Glu Asn
 115 120 125

Tyr Gly Lys Gly Ile Glu Trp Tyr Arg Lys Lys Met Pro Phe Ser Tyr
 130 135 140

Pro Gln Gln Ile Thr Ile Glu Lys Ser Pro Ala Tyr Phe Ile Thr Glu
 145 150 155 160

Glu Val Pro Glu Arg Ile Tyr Lys Met Asn Ser Ser Ile Lys Leu Leu
 165 170 175

Ile Ile Val Arg Glu Pro Thr Thr Arg Ala Ile Ser Asp Tyr Thr Gln
 180 185 190

Val Leu Glu Gly Lys Glu Arg Lys Asn Lys Thr Tyr Tyr Lys Phe Glu
 195 200 205

Lys Leu Ala Ile Asp Pro Asn Thr Cys Glu Val Asn Thr Lys Tyr Lys
 210 215 220

Ala Val Arg Thr Ser Ile Tyr Thr Lys His Leu Glu Arg Trp Leu Lys
 225 230 235 240

Tyr Phe Pro Ile Glu Gln Phe His Val Val Asp Gly Asp Arg Leu Ile
 245 250 255

Thr Glu Pro Leu Pro Glu Leu Gln Leu Val Glu Lys Phe Leu Asn Leu
 260 265 270

Pro Pro Arg Ile Ser Gln Tyr Asn Leu Tyr Phe Asn Ala Thr Arg Gly
 275 280 285

Phe Tyr Cys Leu Arg Phe Asn Ile Ile Phe Asn Lys Cys Leu Ala Gly
 290 295 300

Ser Lys Gly Arg Ile His Pro Glu Val Asp Pro Ser Val Ile Thr Lys
 305 310 315 320

Leu Arg Lys Phe Phe His Pro Phe Asn Gln Lys Phe Tyr Gln Ile Thr
 325 330 335

Gly Arg Thr Leu Asn Trp Pro
 340

<210> 11
 <211> 33
 <212> DNA

<213> Artificial

<220>

<223> 5' primer for amplification by PCR of N-terminal portion of human
3-OST-5

<400> 11

aatttgatc cccagagttg ggagcttgga tag

33

<210> 12

<211> 25

<212> DNA

<213> Artificial

<220>

<223> 3' primer for amplification by PCR of N-terminal portion of human
3-OST-5

<400> 12

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25